

## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

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Applicant's or agent's file reference 113167	<b>FOR FURTHER ACTION</b> See Form PCT/IPEA/416	
International application No. <b>PCT/AU2004/001643</b>	International filing date ( <i>day/month/year</i> ) 3 December 2004	Priority date ( <i>day/month/year</i> ) 5 December 2003
International Patent Classification (IPC) or national classification and IPC  Int. Cl.  <b>H02K 29/00</b> (2006.01) <b>H02P 6/00</b> (2006.01)		
Applicant <b>PRECURSOR ENGINEERING PTY LTD et al</b>		

<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 4 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> (<i>sent to the applicant and to the International Bureau</i>) a total of 5 sheets, as follows:</p> <p><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (<i>sent to the International Bureau only</i>) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or table related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>	
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the report</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>	

Date of submission of the demand 29 September 2005	Date of completion of this report 22 March 2006
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustalia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer  <b>MANO RAMACHANDRAN</b> Telephone No. (02) 6283 2166

**Box No. I Basis of the report**

1. With regard to the **language**, this report is based on:
- ☒ The international application in the language in which it was filed
- ☐ A translation of the international application into \_\_\_\_\_, which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3(a) and 23.1 (b))
- ☐ publication of the international application (under Rule 12.4(a))
- ☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a))
2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:
- ☐ the international application as originally filed/furnished
- ☒ the description:
- pages **1-12** as originally filed/furnished
- pages\* received by this Authority on \_\_\_\_\_ with the letter of \_\_\_\_\_
- pages\* received by this Authority on \_\_\_\_\_ with the letter of \_\_\_\_\_
- ☒ the claims:
- pages as originally filed/furnished
- pages\* as amended (together with any statement) under Article 19
- pages\* **13-17** received by this Authority on **29 September 2005** with the letter of 29 September 2005
- pages\* received by this Authority on \_\_\_\_\_ with the letter of \_\_\_\_\_
- ☒ the drawings:
- pages **1-6** as originally filed/furnished
- pages\* received by this Authority on \_\_\_\_\_ with the letter of \_\_\_\_\_
- pages\* received by this Authority on \_\_\_\_\_ with the letter of \_\_\_\_\_
- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.
3. ☒ The amendments have resulted in the cancellation of:
- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos **2,15,21**.
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to the sequence listing (*specify*): \_\_\_\_\_
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to the sequence listing (*specify*): \_\_\_\_\_

\* If item 4 applies, some or all of those sheets may be marked "superseded."

**Box No. V** Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

## 1. Statement

Novelty (N)	Claims 1,3-14,16-20,22-26	YES
	Claims	NO
Inventive step (IS)	Claims	YES
	Claims 1,3-14,16-20,22-26	NO
Industrial applicability (IA)	Claims 1,3-14,16-20,22-26	YES
	Claims	NO

## 2. Citations and explanations (Rule 70.7)

D1: US 5179307 A

D2: CA 1191543 A

D3: US 4475068 A

D4: WO 1991020120 A

D5: JP 2002-084725 A

D6: EP 0148347 B1

D7: US 4025831 A

NOVELTY (N) claims 1, 3-14, 16-20, 22-26:

None of the citations D1 to D7 discloses all of the features of independent claims 1, 13 and 14. Claims 3-12, 16-20, 22-26 appended to claims 1 or 13 or 14 claim additional features and hence the invention claimed in claims 1, 3-14, 16-20, 22-26 is considered to be novel.

INVENTIVE STEP (IS) claims 1, 3-14, 16-20, 22-26:

Citation D1 discloses a switched DC rotating electrical machine [column 2, lines 17-20] comprising a stator [40], a rotor [10] and switching means [fig 5, Q3-Q6], one of said stator and rotor comprising an excitation winding [fig 2, 50, 52] having a first and a second input [fig 5], the excitation winding being adapted when energized to cause magnetization of an even plurality of poles associated with said excitation winding [figs 1, 2], the switching means being adapted to be associated with a DC voltage source [Fig 5, B1, B2] to switch the output thereof to the first and a second input of the excitation winding [Fig 5], the DC voltage source providing a low voltage output, a high voltage output and an intermediate voltage output having an electrical potential intermediate the electrical potentials of the high voltage output and the low voltage output, wherein in use the intermediate voltage output is continuously connected to the first input of said excitation winding and the second input is switched in a cyclic operation by said switching means between connection with the high voltage output and the low voltage output [column 3, line 64- column 4, line 15, fig 5].

Each of the citations D2-D7 discloses a switched DC rotating electrical machine comprising a stator, a rotor and switching means, one of said stator and rotor comprising an excitation winding having a first and a second input, the excitation winding being adapted when energized to cause magnetization of an even plurality of poles associated with said excitation winding, the switching means being adapted to be associated with a DC voltage source to switch the output thereof to the first and a second input of the excitation winding, cyclic operation of the switching means includes segments of time where one of the inputs is disconnected from the DC voltage output.

**Supplemental Box**

In case the space in any of the preceding boxes is not sufficient.

Continuation of Box V:

Hence when the disclosure of citation D1 is combined with the disclosure of any one of the citations D2-D7 as would be obvious to a person skilled in the art disclose all of the features of claims 1, 3-10, 12-14, 17-20, 22-24 and 26.

Additional features of claims 11,16 and 25 merely amount to common general knowledge and hence do not involve an inventive step.

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**The Claims Defining the Invention are as Follows:**

1. A switched DC rotating electrical machine comprising a stator, a rotor and switching means, one of said stator and rotor comprising an excitation winding having a first and a second input, the excitation winding being adapted when energized to cause magnetization of an even plurality of poles associated with said excitation winding, the switching means being, in use, associated with a DC voltage source, the DC voltage source providing a low voltage output, a high voltage output and an intermediate voltage output having an electrical potential intermediate the electrical potentials of the high voltage output and the low voltage output, wherein in use the intermediate voltage output is continuously connected to the first input and the second input is switched in a cyclic operation by said switching means between connection with the high voltage output and the low voltage output and wherein the cycle of the cyclic operation also includes segments of time when the second input is disconnected from either of said low voltage or high voltage outputs.
2. (Cancelled)
3. An electrical machine as claimed at claim 1 wherein the excitation winding is configured to energize adjacent poles associated with said excitation winding with opposite magnetic polarity.
4. An electrical machine as claimed at any one of the previous claims wherein the voltage differential between the low voltage output and the intermediate voltage output is substantially the same as the voltage differential between the intermediate voltage output and the high voltage output.
5. An electrical machine as claimed at any one of the previous claims wherein the other of said stator and rotor not comprising said excitation winding comprises an even plurality of poles.

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6. An electrical machine as claimed at any one of the previous claims wherein the switching of the switching means is synchronised with the rotation of the rotor.
7. An electrical machine as claimed at claim 6 wherein switching means comprises sensing means adapted to cause switching of the switching means  
5 according to the rotational position of the rotor.
8. An electrical machine as claimed at claim 7 wherein the sensing means comprises a photoelectric sensor.
9. An electrical machine as claimed at claim 7 or claim 8 wherein a timing wheel is associated with the sensing means to provide a reference for the  
10 rotational position of the rotor.
10. An electrical machine as claimed at any one of claims 6 to 9 wherein the second input is switched to the high voltage output or to the low voltage output when a pole of the rotor is positioned in opposed relationship to a pole of the stator.
- 15 11. An electrical machine as claimed at any one of claims 6 to 10 wherein the second input is switched to a disconnected state substantially at a predetermined moment selected to minimize transient currents.
12. An electrical machine as claimed at claim 11 wherein the second input is disconnected from the DC voltage source for a substantial proportion of the cyclic  
20 period.
13. A switched DC rotating electrical machine comprising a stator, a rotor and switching means, the stator being configured with a stator set of poles comprising a plurality of magnetic poles and the rotor being configured with a rotor set of poles comprising a plurality of magnetic poles, a one set of said stator set and  
25 rotor set being configured to provide a magnetic field and the other set of said stator set and rotor set being configured with an excitation coil associated with each pole of said other set, said coils being adapted to be excited by a DC

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- voltage source by means of a first input and a second input to thereby induce a magnetic field in association with each pole, said coils being configured to cause said magnetic fields of adjacent poles to be magnetized to opposite polarity, connection to said DC voltage source being controlled by said switching means
- 5 whereby in use, by the rotation of the rotor with respect to the stator, the magnetic field of the one set is adapted to move relative to the poles of the other set, the DC voltage source having a low voltage output, a high voltage output and an intermediate voltage output having an electrical potential intermediate the electrical potentials of the high voltage output and the low voltage output, the
- 10 intermediate voltage output being in use, continuously connected to the first input and the second input being adapted to be cyclically switched by said switching means between said low voltage output and said high voltage output and wherein the cycle of the cyclic operation also includes segments of time when the second input is disconnected from either of said low voltage or high voltage outputs.
- 15 14. A switched DC rotating electrical machine comprising a stator, a rotor and switching means, one of said stator and rotor comprising an excitation winding having a first and a second input, the excitation winding being adapted when energized to cause magnetization of a first even plurality of poles associated with said excitation winding and being configured to energize poles adjacent said
- 20 associated poles with opposite magnetic polarity, the other of said stator and rotor comprising a second even plurality of poles, the switching means being associated with a DC voltage source having a low voltage output, a high voltage output and an intermediate voltage output having an electrical potential intermediate the electrical potentials of the high voltage output and the low
- 25 voltage output, wherein, in use, the intermediate voltage output is continuously connected to the first input of said excitation winding and the second input is switched in said cyclic operation by said switching means between connection with the high voltage output and the low voltage output, the switching means being configured to cause switching of the excitation winding to an energized
- 30 state when a pole of the rotor is positioned in opposed relationship to a pole of the stator and wherein the cycle of the cyclic operation also includes segments of

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time when the second input is switched to a state disconnected from the DC voltage source.

15. (Cancelled)

16. An electrical machine as claimed at claim 13 or claim 14 wherein the second input is switched to said disconnected state substantially at a predetermined moment selected to minimize transient currents.

17. An electrical machine as claimed at claim 16 wherein the switching of the switching means is synchronised with the rotation of the rotor.

18. An electrical machine as claimed at any claim 17 wherein switching means comprises sensing means adapted to cause switching of the switching means according to the rotational position of the rotor.

19. An electrical machine as claimed at claim 18 wherein the sensing means comprises a photoelectric sensor.

20. An electrical machine as claimed at claim 18 or claim 19 wherein a timing wheel is associated with the sensing means to provide a reference for the rotational position of the rotor.

21. (Cancelled)

22. An electrical machine as claimed at any one of the previous claims wherein the electrical machine is an electric motor.

23. An electrical machine as claimed at any one of claims 1 to 21 wherein the electrical machine is an electric generator.

24. An electrical machine as claimed at any one of the previous claims wherein the excitation winding is associated with the stator.



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25. An electrical machine as claimed at claim 24 wherein the rotor comprises a winding energized from a DC power supply via slip rings.

26. An electrical machine as claimed at claim 24 wherein the rotor comprises a permanent magnet.

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